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REMARKS/ARGUMENTS

Claims 1-36 are pending. Claims 1, 2, 5-13, 17, 18, 20, 21, 25-29 and 31 have been amended. New claim 36 has been added.

Claim 20 was rejected under 35 U.S.C. § 112, second paragraph. Claim 20 has been amended.

Claims 1-3, 5, 8, 10, 11-15, 17-18, 20-22, and 26-33 were rejected under 35 U.S.C. § 102(b) as being anticipated by Hattori et al. Applicants respectfully traverse the rejection. Claim 1 is directed to a charged particle beam apparatus. The claim recites, "...a particle image detection unit for obtaining a plurality of 2-dimensional particle images by detection of a particle images generated by said sample scanned by the irradiation of said charged particle beam converged by said charged particle optical system, where a single 2-dimensional particle image is obtained for each focal position; an image processing unit for computing a focal offset and said astigmatism of said converged charged particle beam on the basis of said plurality of 2-dimensional particle images obtained by said particle image detection unit at different focal positions controlled by said focal position control system; and a control system for adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity based on said astigmatism computed by said image processing unit to said astigmatism adjustment, wherein a cross-sectional shape of said charged particle beam at an astigmatism adjusted focal position is circle and said image processing means computes said astigmatism by using at least three directional sharpness magnitudes which are obtained from said single 2-dimensional particle image at each focal position."

The claimed embodiment derives at least three directional sharpness magnitudes from a single charge particle image obtained at each focal position of the converged charged particle beam. This is possible due to the shape of the charged particle beam that irradiates and scans on a surface of the sample. The cross-sectional shape of the charged particle beam has circular shape at an astigmatism adjusted position. The claimed embodiment also provides

information of directional sharpness magnitudes in at least three directions using the patterns formed on a sample. The patterns have edges in three or more directions (see Figs. 4 and 7).

Hattori et al., however, uses two charged particle images at each focal position because the image in Hattori et al. provides information of two directional sharpness magnitudes. Hattori uses two shapes, rectangular for the first scan and triangle for the second scan (col. 6, line 64 to col. 7, line 8). The first scan provides information of two directional sharpness magnitudes in the directions of 0 and 90 degrees. The second scan provides information of another two directional sharpness magnitudes in the directions of 45 and 135 degrees.

Accordingly, Hattori does not disclose "...a particle image detection unit for obtaining a plurality of 2-dimensional particle images by detection of a particle images generated by said sample scanned by the irradiation of said charged particle beam converged by said charged particle optical system, where a single 2-dimensional particle image is obtained for each focal position...wherein a cross-sectional shape of said charged particle beam at an astigmatism adjusted focal position is circle and said image processing means computes said astigmatism by using at least three directional sharpness magnitudes which are obtained from said single 2-dimensional particle image at each focal position." Claim 1 is allowable.

Claim 10 recites, "... a particle image detection means for obtaining a single 2-dimensional particle image at each focal position by changing focal position with use of said focal position control system and detecting particles generated from a surface of said sample by the irradiation and the scanning of said charged particle beam with use of said scanning means; an image processing means for computing said astigmatism of said converged charged particle beam on the basis of said 2 dimensional particle images at each focal position obtained by said particle image detection means..." Hattori et al. does not disclose at least the above recited features. Claim 10 is allowable.

Claim 27 is directed to an automatic astigmatism adjustment. The claim recites, "...changing a focal position of said converged charged particle beam; obtaining a single 2-dimensional particle image at each focal position of said converged charged particle beam..." Hattori et al. does not disclose at least the above features. Claim 27 is allowable.

Claim 28 directed to an automatic astigmatism adjustment. The claim recites, "...obtaining a plurality of 2 dimensional particle images having different focal positions of said converged charged particle beam by detection of particles generated from said sample by said radiating, where a single 2-dimensional particle image is obtained for each focal position...wherein a cross-sectional shape of said charged particle beam at an astigmatism adjusted focal position is circle and in the step of computing, said astigmatism is computed by using at least three directional sharpness magnitudes which are obtained from said single 2 dimensional particle image at each focal position." Hattori et al. does not disclose at least the above features. Claim 28 is allowable.

Claim 29 recites, "...obtaining a plurality of 2 dimensional particle images having different focal positions of said converged charged particle beam by detection of particles generated from said sample by said radiating; computing directional sharpness magnitudes for at least 3 directions from said plurality of 2 dimensional particle images; computing in focus positions using said computed directional sharpness magnitudes for at least said 3 directions; computing astigmatism of said converged charged particle beam from a relation among said computed in focus positions at said computed directional sharpness magnitudes for at least said 3 directions..." Hattori et al. does not disclose at least the above features. Claim 29 is allowable.

Claim 31 recites, "...obtaining a plurality of 2 dimensional particle images having different focal positions of said converged particle beam by detection of particles generated from said sample by said radiating; computing directional sharpness magnitudes for at least 3 directions for a plurality of focal position positions from said plurality of 2 dimensional particle images;. computing in focus positions using said computed directional sharpness magnitudes for at least said 3 directions; computing astigmatism of said converged charged particle beam from a relation among said computed in focus positions at said computed directional sharpness magnitudes for at least said 3 directions..." Hattori et al. does not disclose at least the above features. Claim 31 is allowable.

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Amdt. dated August 13, 2003
Reply to Office Action of March 13, 2003

PATENT

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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